The Analysis of Verbal Behavior 2012, **28,** 145–150

Manipulating Motivating Operations to Facilitate the Emergence of Mands for a Child With Autism

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Research on the functional independence of verbal operants (Skinner, 1957) has demonstrated inconsistent findings. One explanation may be that these studies have not manipulated the motivating operation (MO) to facilitate the emergence of mands (Hall & Sundberg, 1987; Lamarre & Holland, 1985). In the current study, 1 participant, diagnosed with autism, was taught to tact high-preference and low-preference leisure items, and emergence of mands was tested under varying MO conditions. Results showed the emergence of mands following periods of arranged deprivation, and greater maintenance for a highly preferred relative to a less preferred stimulus. However, mands only emerged when presession tact trials were conducted. These results suggest that in a state of deprivation, transfer of stimulus control from discriminative to motivational conditions may occur without direct training.
Key words: mand, tact, motivating operation, verbal operant, autism

Language training programs for communication deficits exhibited by children with autism often focus on training verbal operants, such as mands and tacts (e.g., Kelley, Shillingsburg, Castro, Addison, & LaRue, 2007; Lerman et al., 2005). Although the form of the tact and mand may be identical, they involve separate functional relations (Skinner, 1957). Several studies have demonstrated the functional independence of mands and tacts using human and nonhuman participants (e.g., Hall & Sundberg, 1987; Lamarre & Holland, 1985; Savage-Rumbaugh, 1984). Hall and Sundberg examined if teaching a response as a tact was sufficient to produce the corresponding mand with 2 human participants. Tact training was initiated for items necessary to complete a response chain (e.g., make instant soup). Mand probes were then conducted to determine if the response taught as a tact also functioned as a mand when an item necessary to complete the chain (e.g., the can opener) was missing. Participants acquired the response when trained as a tact; however, direct training was required for mands to occur. A limited literature does exist, however, that contradicts the notion of the functional independence of mands and tacts (e.g., Kelly et al., 2007; Petursdottir, Carr, & Michael, 2005), and one notable exception to Hall and Sundberg's findings is a study by Wallace, Iwata, and Hanley (2006).

Wallace et al. (2006) showed that training a response as a tact would facilitate the emergence of the corresponding mand *under specific conditions*. Their participants were 3 adults with developmental disabilities who were taught to tact both high-preference and nonpreferred or low-preference leisure stimuli. Following tact training, the experimenters tested for the emergence of mands. The participants emitted mands for the high-preference stimuli at close to optimal level, demonstrating successful emergence of mands for the preferred item.

Procedural differences may account for the differential outcomes between previous research (e.g., Hall & Sundberg, 1987) and

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This research is based on a project submitted in partial fulfillment of the requirements for the master of arts degree by the first author. We would like to thank John Borrero and Heather Jennett for their comments on previous versions of this manuscript.

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those of Wallace et al. (2006). Wallace et al. noted that if a response is taught as a tact, it may later occur as a mand when ''access to the object functions as a reinforcer'' (2006, p. 19). Given that Hall and Sundberg did not conduct a formal assessment to identify potential reinforcers (i.e., preference assessment), it is unclear if the stimuli delivered for emitting the response were actual reinforcers.

Another factor that may determine if a response taught as a tact occurs as a mand is the absence or presence of the relevant motivating operation (MO). Kooistra , Buchmeier, and Klatt (2012) demonstrated, with 2 participants, that transfer from tact control to mand control may occur under deprivation conditions. However, these results were preliminary and the researchers only included highly preferred stimuli. Therefore, the purpose of the current study was to replicate Wallace et al. (2006) as well as to evaluate the effect of MO manipulations on emergence of mands following tact training.

METHODS

Participant and Setting

Darren was a 4-year-old boy with autism who received speech therapy twice a week. Darren demonstrated generalized verbal imitation and had a very limited tact repertoire (e.g., 5–10 vocal tacts). He did not mand independently. Sessions were conducted once or twice per week in a therapy room located in a hospital. Two to five sessions were conducted during each visit and were typically 5 to 10 min in duration.

Response Measurement and Interobserver Agreement

A *prompted tact* was defined as emitting the correct vocal response within 5 s of the model prompt in the presence of the corresponding stimulus and following the question ''What is it?'' An *independent tact* was defined identically, except that the response had to be emitted in the absence of the model prompt. A *mand* was defined as emitting the predetermined vocal response in the presence of the corresponding high-preference (HP) or low-preference (LP) stimulus when the question, ''What is it?'' was absent. *Item interaction* was defined as manipulating the stimulus in an appropriate manner (e.g., moving the Toy Story figurine as if flying in the air). Item interaction was not scored for interacting with the stimulus in an inappropriate manner (e.g., throwing the Toy Story figurine at the experimenter). Paper and pencil data were collected on the frequency of tacts and mands. The frequency of tacts was converted to percentage of trials correct and the frequency of mands was converted to responses per min (RPM).

Two observers independently but simultaneously collected data during 32% and 23% of tact (baseline and training) and mand (baseline and tests) sessions, respectively. Interobserver agreement was calculated for tact sessions by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100. An agreement for tacts was defined as both observers recording that a particular response occurred on a given trial. Agreement was calculated for mand sessions by dividing the smaller number of scored responses by the larger number of scored responses within each 10-s interval, averaging these scores across the total number of intervals, and multiplying the resulting product by 100. Agreement during tact sessions averaged 98.13% (range 80–100%) and agreement during mand sessions averaged 98% (range 93–100%) and 99% (range 90–100%) for the HP and LP mand conditions, respectively.

Procedures

A preference assessment (Fisher et al., 1992) was conducted to identify HP and LP stimuli. Nine tangible stimuli were included based on parental report. One HP stimulus (the highest ranked item; Toy Story figurine) and one LP stimulus (the lowest ranked item; Cookie Monster blocks) were selected as target stimuli. Following an extended break between sessions due to illness, the preference assessment was repeated; the second preference assessment identified the same HP and LP stimuli.

Baseline (mand and tact). All sessions consisted of 10 mass trials of HP or LP stimulus presentation (tact) or 10 min (mand) and were conducted at a table. During the tact baseline, a trial consisted of the exper-

imenter asking, ''What is it?'' while simultaneously holding up either the HP or LP stimulus; in other words, a session consisted of 10 trials of *one* stimulus only. Praise was provided for a correct tact response and incorrect responding resulted in the termination of the trial. No other programmed consequences were provided. During the mand baseline, sessions were conducted following a deprivation period, which was identical to the deprivation condition arranged during the treatment evaluation (see below). A session began with *both* items being presented simultaneously on the table; the stimuli were out of reach but arranged such that they were visible to Darren if he faced forward. The experimenter did not deliver prompts for Darren to request the items. Mands resulted in 30-s access to the requested stimulus; praise was not provided. Darren was not allowed access to the items if other forms of requests (e.g., pointing to the stimulus, attempting to take the stimulus) occurred, and no other programmed consequences were implemented.

Tact training. Sessions were similar to the tact baseline, except training was conducted using a progressive prompt delay procedure (i.e., immediate model prompt, 2-s delay to model, 5-s delay to model, and no model). A trial began with the question, ''What is it?'' The experimenter held up either the HP or LP stimulus and immediately provided the model prompt (or provided the model prompt following a delay). Praise was provided for a correct tact. If Darren responded incorrectly or did not respond within 5 s of the prompt, the question was repeated and a model prompt was delivered. If he did not respond within 5 s of the model prompt, the experimenter modeled the appropriate response and moved on to the next trial. The criterion to move to the next delay step within tact training was correctly tacting the stimulus during at least 80% of trials for three consecutive sessions at the current prompt delay. Criteria for mastery of tact training included either (a) three consecutive sessions in which Darren independently tacted both items during at least 80% of trials in the final phase (i.e., no model prompt) or (b) five consecutive sessions in which Darren independently tacted the stimuli with 80% or greater accuracy regardless of the prompt sequence step.

Mand test. Following tact training, sessions were conducted to observe if transfer of control from discriminative to motivational conditions would occur following arranged periods of deprivation or satiation. During each visit, one deprivation session and one satiation session was conducted, beginning with the deprivation session. Sessions were otherwise similar to those of the mand baseline. Beginning at session 10, three tact trials were conducted per stimulus at the start of each visit in an effort to facilitate the emergence of mands. Upon arrival, the experimenter greeted Darren and escorted him to the entrance of the session room, where she held up the stimulus and asked, ''What is it?'' Praise was provided for correct answers; the experimenter did not correct incorrect responses. Following these trials, Darren was led into the session room, and mand test sessions began immediately.

Deprivation. Darren's caregiver was instructed to remove the HP and LP stimuli from the home and surrounding areas until the next scheduled visit (2 to 3 days). Upon arrival, Darren was greeted by the experimenter and escorted to a session room, where the deprivation session began immediately.

Satiation. Sessions were similar to the mand baseline except that following a deprivation mand test session, Darren was given access to the HP and LP stimuli simultaneously and told, ''You can do what you like.'' Session began after 2-consecutive min without engagement with either stimulus. The mean duration of presession access prior to satiation sessions was 13 min (range 2–25 min). Although data were not collected on item interaction separately, Darren had access to both of the stimuli simultaneously.

Experimental Sequence and Design

First, a series of baseline mand and tact sessions was conducted to determine a baseline level of responding. Second, tact training was conducted until Darren acquired the tact for both the HP and LP stimuli. Third, mand test sessions with HP and LP stimuli across deprivation and satiation were initiated. Mand test sessions were conducted pre and post tact training, and we used a multi-element design to evaluate differences between deprivation and satiation conditions as well as LP and HP stimuli.

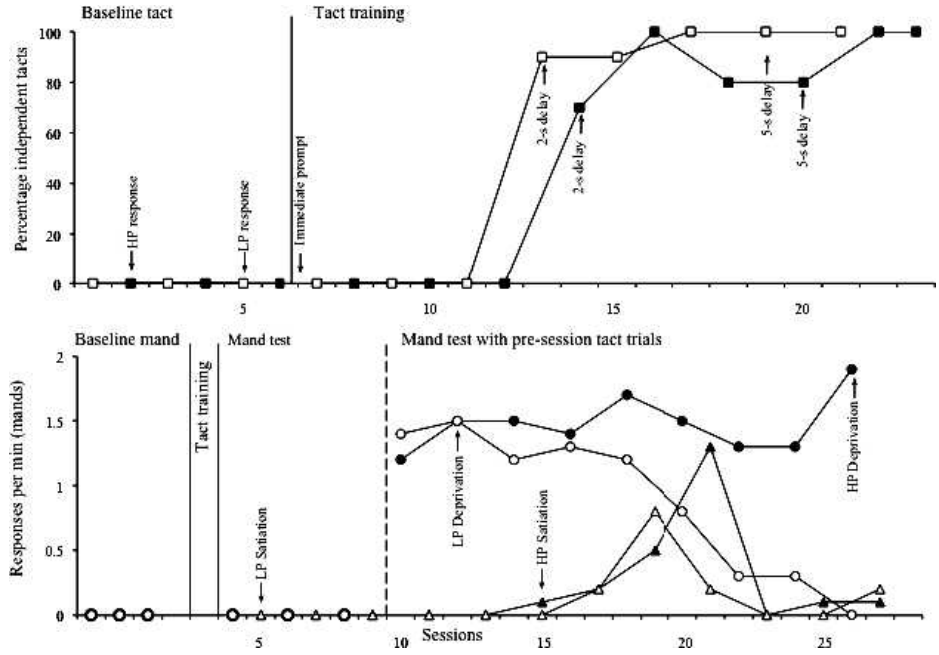

Figure 1. The top panel depicts the percentage of independent tacts during baseline and training. The bottom panel depicts the rate of mands during the baseline and mand test. Baseline mand and tact sessions were conducted first followed by tact training, mand test, and then mand test with presession tact trials.

RESULTS AND DISCUSSION

As depicted in the Figure, Darren did not independently tact either stimulus during tact baseline sessions (top panel). Once tact training was introduced, Darren acquired both responses as tacts within 17 sessions. During mand baseline sessions (bottom panel), Darren did not mand for either stimulus nor did he emit any incorrect responses for the stimuli; he occasionally reached or pointed to the stimuli. Following tact training, mand test sessions were initiated. Mands did not initially emerge under conditions of deprivation or satiation for either the HP or LP stimuli. With the addition of presession tact trials, Darren began to mand for both stimuli under conditions of deprivation. Responding for the LP stimulus persisted for five sessions before subsequently decreasing to near zero rates during the final three sessions, averaging .67 RPM. However, mands for the HP stimulus during this condition maintained until the end of the evaluation and occurred at stable rates, averaging 1.47 RPM. In the satiation condition, responding occurred at low rates, averaging .26 RPM and .16 RPM for HP and LP stimuli, respectively.

The results of the current study replicate and extend those of Wallace et al. (2006) by demonstrating transfer of control from discriminative to motivational conditions in the absence of direct mand training. Responding for the LP stimulus eventually decreased; whereas, manding persisted for the HP stimulus. These results suggest that relative reinforcer value, as estimated via preference assessments, may help predict if access to a particular stimulus is likely to maintain the corresponding mand over time. The current results also extend this previous research by demonstrating the importance of manipulating the MO (Kooistra et al., 2012). The results of our study suggest that, for Darren, deprivation of the stimuli may have had an evocative effect on mands for the HP stimulus whereas satiation may have had an abolishing effect.

In the current preparation, we were not able to entirely separate the effects of the independent variable from the effects of reinforcement during the session. That is, providing

access to the item contingent upon mands may have contributed to maintenance of the mands (Kooistra et al., 2012). Although this is possible given the differential pattern of responding observed across conditions, it is more likely that deprivation had an evocative effect on mands for the HP stimulus whereas satiation had an abolishing effect. Future research might evaluate mand test sessions without programmed consequences (extinction) to further isolate the effects of manipulating the MO (e.g., Rosales & Rehfeldt, 2007; Wallace et al., 2006).

A possible procedural limitation is that tact training was conducted using a mass-trial presentation; that is, the same stimulus was repeatedly presented within a single session. Therefore, it is possible that responding may not have come under stimulus control; rather, Darren may have been simply emitting the last response that was prompted and reinforced. However, this may be unlikely given that Darren independently tacted during 100% of the trials during the last several tact training sessions and that independent tacting persisted during the pre-session tact trials of the mand test. Future researchers might evaluate tact training procedures that would further mitigate this concern (e.g., Kooistra et al., 2012).

Another limitation may be that mands did not emerge until presession tact trials were conducted. Because several days or weeks sometimes elapsed between sessions, we felt it was reasonable to include the presession tact trials as a booster. However, we did not experimentally manipulate the presession tact trials; thus, we cannot be certain if the presession tact trials were critical for producing emergent mands. Further, it is unclear if mands would have persisted in the absence of these trials. It is possible that these presession tact trials served to prime the mand responses (Catania, 1998) or tact responses that were subsequently reinforced as mands. Additionally, a limited number of studies have demonstrated the importance of antecedent variables in emergent responding (e.g., Egan & Barnes-Holmes, 2011; Sigafoos, Doss, & Reichle, 1989). Sigafoos, Doss, and Reichle demonstrated that when previously mastered tact trials preceded mand training sessions, mands increased; therefore, presession tact trials may have served as a necessary antecedent variable. Nevertheless, it is important to note that in the current study, mands still emerged under conditions of deprivation in the absence of direct mand training. Future research could evaluate this concern by manipulating the presession tact trials; in other words, researchers could conduct a component analysis of the procedures necessary to produce mands.

A final potential limitation to our study may have been our deprivation period. First, the length of deprivation was not empirically determined; rather, it was based on the participant's attendance. Given the age of the participant, we chose a minimum length of time that we presumed to be sufficient to create a condition of deprivation. Future research can examine methods of empirically determining the deprivation period. Second, we relied on Darren's parents to withhold the stimulus during the deprivation period. They assured us that he did not have access to either stimulus at home, and practical considerations as well as the need to have a sufficient period of deprivation prevented us from a more controlled deprivation period. Finally, although the rationale for conducting deprivation sessions prior to satiation sessions is warranted, it is difficult to eliminate the possibility that sequence effects may have been evident in the results. Future investigations should randomly select the order of conditions in an effort to control for this potential threat to internal validity.

Although the results of this study should be considered preliminary, they suggest that, for Darren, presession deprivation facilitated the occurrence of manding regardless of preference. However, preference may predict if manding will maintain. The current findings add to the small body of literature suggesting that acquisition of tacts may facilitate the occurrence of corresponding mands under specific conditions (e.g., Kelley et al., 2007; Kooistra et al., 2012; Petursdottir et al., 2005; Wallace et al., 2006). The current results also provide support for the practice of arranging for periods of deprivation to facilitate mand acquisition. Future research should assess the generality of these findings across participants, and evaluate generalization of manding across settings and people.

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